Circularity and Landscape experience of Agriphotovoltaics. A Systematic Review of Literature and Built Systems

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Background

The world is facing considerable challenges while aiming to reduce greenhouse gas emissions by means of transitioning to renewable energy and circularity. Solar energy presents a key energy source, giving rise to innovative agriphotovoltaics (APV) systems that combine agricultural with solar power production. This study identifies aspects of circularity and landscape experience of built international APV projects, focusing on APV projects in the Netherlands.

Methods and data

During the systematic review, we examined peer-reviewed papers for 16 international APV cases and grey literature for 10 Dutch APV cases, published up to January 2022 (Fig. 1). To define aspects of circularity we identified critical performance indicators of circular agriculture (CPICA) of each studied APV case. Landscape experience was assessed in Dutch APV cases, by following spatial properties: accessibility, visibility, patch configuration and land use beneath photovoltaics arrays.

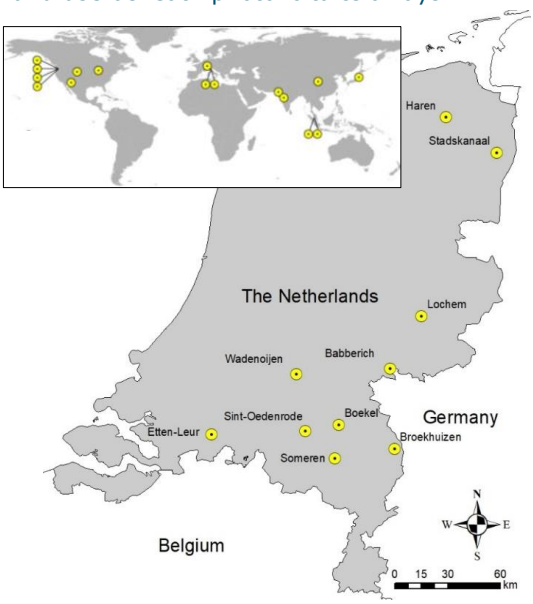

Figure 1: The world map with international APV cases (above) and map of the Netherlands with Dutch APV cases (below). APV cases are depicted with yellow circles.

Results

Circularity aspect was identified in all APV cases. The highest number of international APV cases corresponded to CPICA 'Producing sustainable energy' and 'Contribution to regional economy and vitality of the rural area', 16 and 13 APV cases, respectively. Nature conservation and Using residual flows from food industry were found in zero APV cases (Fig. 2).

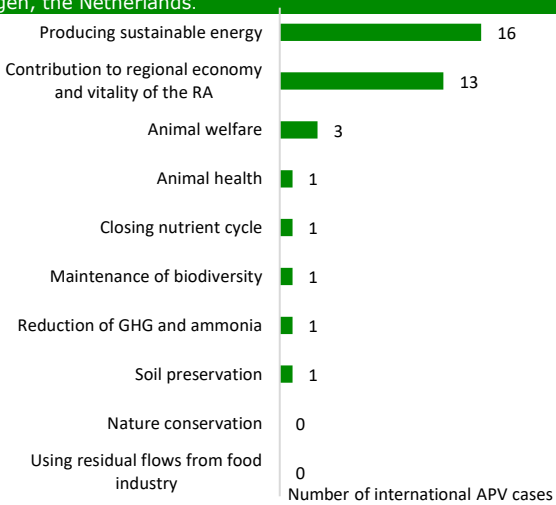

Figure 2: Number of international APV cases with identified critical performance indicators of circular agriculture. RA stands for rural area and GHG stands for greenhouse gases.

Spatial analysis demonstrated low visibility in the majority of Dutch APV cases. Stadskanaal, Someren and Broekhuizen were found completely hidden by landscape users (Fig.3).

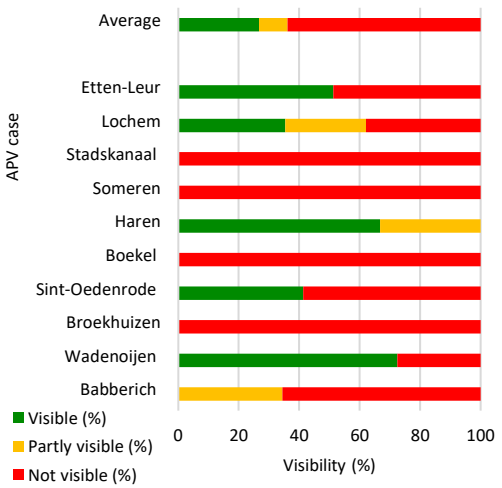

Figure 3: Visibility aspects of solar infrastructures of Dutch APV cases. The percentage of visibility represent the percentage of the perimeter of each APV case.

Conclusions

The most addressed circularity aspect of international and Dutch APV cases are 'producing sustainable renewable energy' and 'contribution to regional economy and vitality of the rural area'. Dutch APV cases indicated relatively low accessibility and visible aspects. APV may become a leading solution of future proof farming, contributing to acceleration of energy transition, mitigation of climate change and circular agriculture.

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